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(54) **LIGHT SOURCE DISTRIBUTOR FOR USE IN WAVELENGTH DIVISION MULTIPLEXED-PASSIVE OPTICAL NETWORK**

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H04J 14/02 (2006.01)

(52) **U.S. Cl.** **398/82**; 398/83; 398/85

(58) **Field of Classification Search** 398/58, 398/66–72, 82–88
See application file for complete search history.

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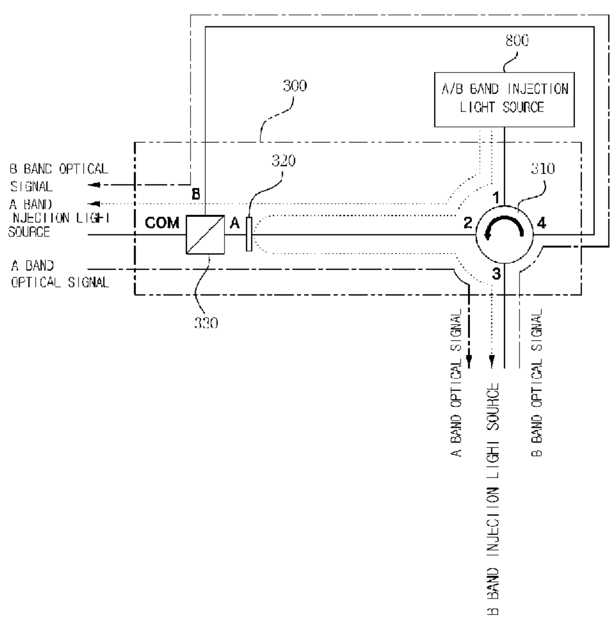
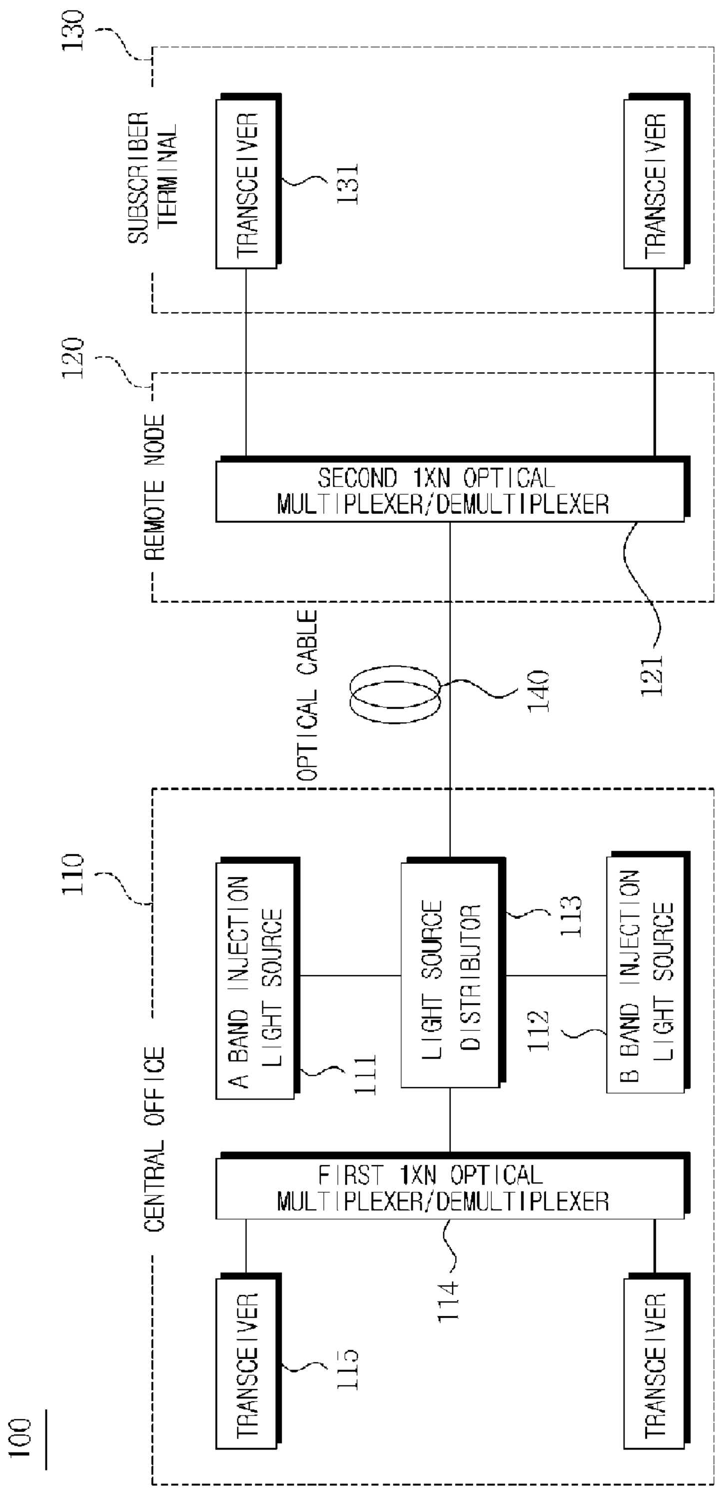
(57) **ABSTRACT**

The present disclosure is directed to a light source distributor for use in an injection-locked WDM-PON (wavelength division multiplexed-passive optical network). The light source distributor receives an A band and a B band injection optical signals through a single optical terminal from an injection light source for outputting both the A band and the B band injection optical signals; transmits the A band injection optical signal to a first optical multiplexer/demultiplexer of a central office and the B band injection signal to a second optical multiplexer/demultiplexer of a remote node; transmits a wavelength-locked A band optical signal received from the first optical multiplexer/demultiplexer to the second optical multiplexer/demultiplexer; and transmits a wavelength-locked B band optical signal received from the second optical multiplexer/demultiplexer to the first optical multiplexer/demultiplexer.

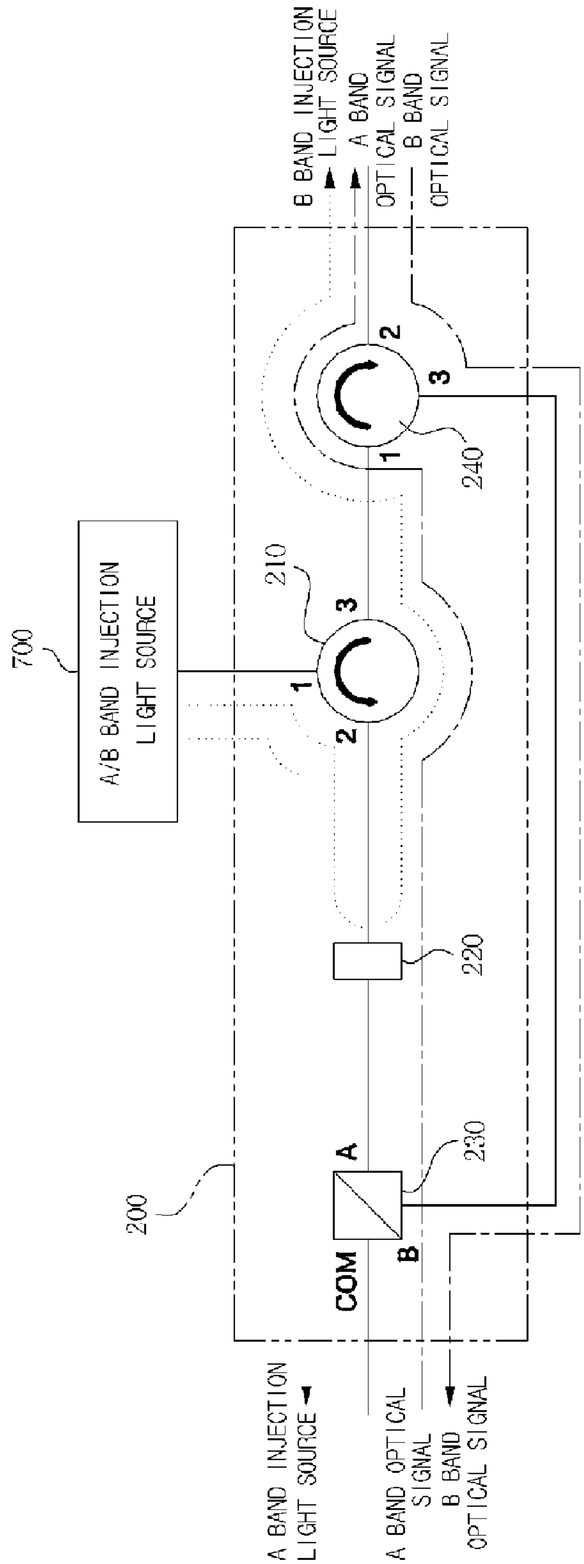
12 Claims, 3 Drawing Sheets



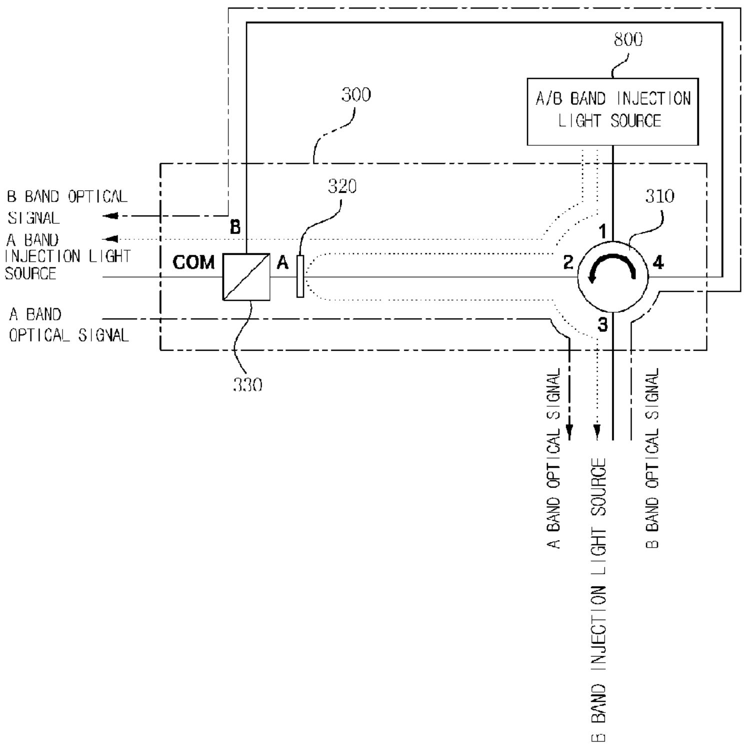
[Fig. 1]


100
CENTRAL OFFICE
110
TRANSCEIVER
115
TRANSCEIVER
FIRST 1XN OPTICAL MULTIPLEXER/DEMULTIPLEXER
114
A BAND INJECTION LIGHT SOURCE
111
LIGHT SOURCE DISTRIBUTOR
113
B BAND INJECTION LIGHT SOURCE
112
OPTICAL CABLE
140
REMOTE NODE
120
SECOND 1XN OPTICAL MULTIPLEXER/DEMULTIPLEXER
121
SUBSCRIBER TERMINAL
130
TRANSCEIVER
131
TRANSCEIVER

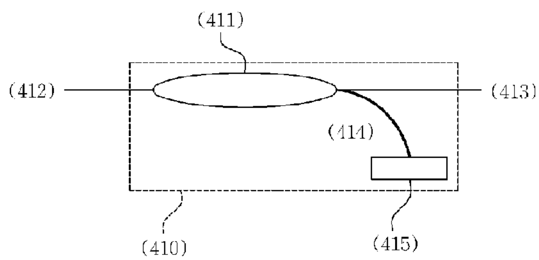
[Fig. 2]


B BAND INJECTION LIGHT SOURCE
A BAND OPTICAL SIGNAL
B BAND OPTICAL SIGNAL
A/B BAND INJECTION LIGHT SOURCE
700
210
240
220
230
200
COM
A
B
1
2
3
A BAND INJECTION LIGHT SOURCE
A BAND OPTICAL SIGNAL
B BAND OPTICAL SIGNAL

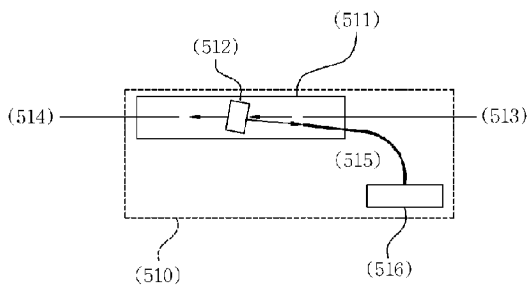
[Fig. 3]



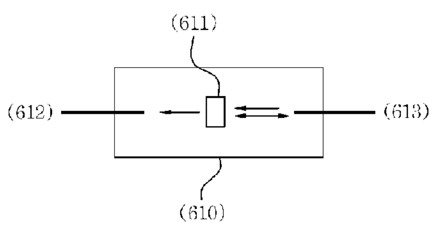
[Fig. 4]



[Fig. 5]



[Fig. 6]



LIGHT SOURCE DISTRIBUTOR FOR USE IN WAVELENGTH DIVISION MULTIPLEXED-PASSIVE OPTICAL NETWORK

TECHNICAL FIELD

The present disclosure relates to a light source distributor; and, more particularly, to a light source distributor for use in an injection-locked WDM-PON (wavelength division multiplexed-passive optical network).

BACKGROUND ART

A wavelength division multiplexed-passive optical network (WDM-PON) provides a high speed broadband communication service by using an inherent wavelength assigned to each subscriber. Accordingly, each subscriber receives a signal having a different wavelength corresponding thereto, so that a security is enhanced and a separate communication service is provided to each subscriber, thereby enlarging a communication capacity.

Conventionally, a method has been proposed wherein a central office and a subscriber terminal have a respective light source including a distributed feedback-laser diode (DFB-LD) element, thereby realizing the WDM-PON.

However, such method has problems that the DFB-LD element is expensive and a temperature control technique is complicated.

Accordingly, a technique using a wavelength-locked optical signal has been widely used by injecting an incoherent light source into a Fabry-Perot Laser Diode (FP-LD) of a low price, thereby implementing a WDM optical signal. Further, in order to obtain much broader transmission bandwidth, a wavelength-fixed optical signal has been also used as the WDM optical signal, wherein the wavelength-fixed optical signal can be provided by applying an injection light source to a reflective semiconductor optical amplifier (RSOA) and modulating a current of the RSOA.

Hereinafter, a configuration of a conventional wavelength division multiplexed-passive optical network **100** will be described in reference to FIG. **1**. FIG. **1** shows a schematic block diagram for showing a conventional bidirectional communication in an injection-locked wavelength division multiplexed-passive optical network.

The injection-locked wavelength division multiplexed-passive optical network **100** includes a central office **110**, a subscriber terminal **130**, a remote note **120** for connecting the central office **110** with each subscriber terminal **130** and an optical cable **140**.

The central office **110** has an A band injection light source **111**, a B band injection light source **112**, a light source distributor **113**, a first 1×N optical multiplexer/demultiplexer **114** and a multiplicity of transceivers **115**.

The remote node **120** has a second 1×N optical multiplexer/demultiplexer **121** and the subscriber terminal **130** has a plurality of transceivers **131**.

The A band injection light source **111** is provided as a light source for an A band optical signal serving as a downstream optical signal. As the A band injection light source **111**, an incoherent light source may be mainly used. The A band injection light source **111** generates the A band injection optical signal, and then transmits it to the light source distributor **113**.

The B band injection light source **112** is provided as a light source for B band optical signal serving as an upstream optical signal, and, like the A band injection light source **111**, an incoherent light source may be mainly used as the B band injection light source **112**. The B band injection light source **112** generates the B band injection optical signal, and then transmits it to the light source distributor **113**.

The light source distributor **113** receives the A band injection optical signal from the A band injection light source **111** and transmits it to the first 1×N optical multiplexer/demultiplexer **114** of the central office **110**. Further, the light source distributor **113** receives a wavelength-locked A band optical signal from the first 1×N optical multiplexer/demultiplexer **114** of the central office **110** and transmits it to the optical cable **140** connected to the remote node **120**.

In addition, the light source distributor **113** receives the B band injection optical signal from the B band injection light source **112** and transmits it to the second 1×N optical multiplexer/demultiplexer **121** of the remote node **120** through the optical cable **140**. Further, the light source distributor **113** receives a wavelength-locked B band optical signal from the second 1×N optical multiplexer/demultiplexer **121** of the remote node **120** and transmits it to the first 1×N optical multiplexer/demultiplexer **114** of the central office **110**.

The first 1×N optical multiplexer/demultiplexer **114** separates the A band optical signal received from the light source distributor **113** according to the wavelength thereof, and then, injects it to each transmitter of the transceivers **115** of the central office **110**. For example, as the first 1×N optical multiplexer/demultiplexer **114**, an arrayed waveguide grating (AWG) may be used.

As the transmitter of the transceivers **115**, the Fabry-Perot Laser Diode (FP-LD) may be used and the transmitter generates the downstream optical signal to be transmitted to each subscriber.

Specifically, if the A band injection optical signal separated based on the wavelength thereof is injected to each transmitter of the transceivers **115**, wavelength elements having a wavelength different from that of the injected optical signal are suppressed and wavelength elements having a wavelength equal to that of the injected optical signal is locked, thereby outputting the wavelength-locked A band downstream optical signal.

Each receiver of the transceivers **115** receives a wavelength-locked B band upstream optical signal from the subscriber terminal **130**, and then, converts it into an electrical signal. A photo diode (PD) may be used as the receiver of the transceivers **115**.

The second 1×N optical multiplexer/demultiplexer **121** of the remote node **120** separates the B band optical signal received from the light source distributor **113** based on the wavelength thereof, and then, injects it to the transceivers **131** of the subscriber terminal **130**. The arrayed waveguide grating (AWG) may be used as the second 1×N optical multiplexer/demultiplexer **121** like the first 1×N optical multiplexer/demultiplexer **114**.

The Fabry-Perot Laser Diode (FP-LD) may be used as the transmitter of the transceivers **131**, for example, and the transmitter generates an upstream optical signal to be transmitted to the central office **110**.

Specifically, if the B band injection optical signal separated according to the wavelength thereof is injected to the transmitter of the transceivers **131**, wavelength elements having a wavelength different from that of the injected optical signal are suppressed and wavelength elements having a wavelength equal to that of the injected optical signal is locked, thereby outputting the wavelength-locked B band upstream optical signal.

Each receiver of the transceivers **131** receives the wavelength-locked A band downstream optical signal from the central office **110**, and then, converts it into an electrical signal. A photo diode (PD) may be used as the receiver of the transceivers **131**.

Accordingly, as described above, the development of the light source distributor is strongly required, the light source capable of receiving the A band injection light source **111** as an input and outputting it to a common terminal of the first 1×N optical multiplexer/demultiplexer **114** of the central office **110** with a minimum optical loss; receiving the B band injection light source **112** as an input and outputting it to the optical cable **140** toward the remote node **120** with a minimum optical loss; transmitting the downstream optical signal outputted from the transmitter of the transceivers **115** of the central office **110** to the optical cable **140** with a minimum optical loss and transmitting the upstream optical signal outputted from the transceivers **131** of the subscriber terminal **130** to the common terminal of the first 1×N optical multiplexer/demultiplexer **114** of the central office **110** with a minimum optical loss.

DISCLOSURE OF INVENTION

Technical Problem

The present disclosure is related to a light source distributor for use in an injection-locked WDM-PON (wavelength division multiplexed-passive optical network).

Technical Solution

The light source distributor receives an A band and a B band injection optical signals through a single optical terminal from an injection light source for outputting both the A band and the B band injection optical signals; transmits the A band injection optical signal to a first optical multiplexer/demultiplexer of a central office and the B band injection signal to a second optical multiplexer/demultiplexer of a remote node; transmits a wavelength-locked A band optical signal received from the first optical multiplexer/demultiplexer to the second optical multiplexer/demultiplexer; and transmits a wavelength-locked B band optical signal received from the second optical multiplexer/demultiplexer to the first optical multiplexer/demultiplexer.

BRIEF DESCRIPTION OF THE DRAWINGS

The disclosure may best be understood by reference to the following description taken in conjunction with the following figures:

FIG. **1** shows a schematic block diagram for showing a conventional bidirectional communication in an injection-locked wavelength division multiplexed-passive optical network;

FIG. **2** sets forth a schematic diagram of a light source distributor for use in an injection-locked wavelength division multiplexed-passive optical network in accordance with a first embodiment of the present invention;

FIG. **3** presents a schematic diagram of a light source distributor for use in an injection-locked wavelength division multiplexed-passive optical network in accordance with a second embodiment of the present invention;

FIG. **4** illustrates a schematic diagram of an A-band pass/B-band reflection filter using a fused fiber WDM coupler in accordance with one embodiment of the present invention;

FIG. **5** offers a schematic diagram of an A-band pass/B-band reflection filter using a three-terminal thin film filter in accordance with one embodiment of the present invention; and

FIG. **6** depicts a schematic diagram of an A-band pass/B-band reflection filter using two-terminal thin film filter in accordance with one embodiment of the present invention.

MODE FOR THE INVENTION

In the following description, numerous specific details are set forth. It will be apparent, however, that these embodiments may be practiced without some or all of these specific details. In other instances, well known process steps or elements have not been described in detail in order not to unnecessarily obscure the disclosure.

Hereinafter, a light source distributor in accordance with a first embodiment of the present invention will be described with reference to FIG. **2**. FIG. **2** sets forth a schematic diagram of a light source distributor **200** for use in an injection-locked wavelength division multiplexed-passive optical network in accordance with the first embodiment of the present invention.

The light source distributor **200** includes a first optical circulator **210**; an A-band pass/B-band reflection filter **220**; an A/B band wavelength mux/demux filter **230** and a second optical circulator **240**.

An injection light source **700** generates both an A band optical signal serving as a downstream optical injection signal and a B band optical signal serving as an upstream optical injection signal. Although an incoherent light source is mainly used as the injection light source **700**, it is possible to employ a coherent light source if necessary. The injection light source **700** outputs an A band and B band optical signals to a first terminal of the first optical circulator **210** of the light source distributor **200**.

The first terminal of the first optical circulator **210** is connected to the injection light source **700**; a second terminal thereof is connected to the A-band pass/B-band reflection filter **220**; and a third terminal thereof is connected to a first terminal of the second optical circulator **240**.

After the first optical circulator **210** receives the A band optical signal and the B band optical signal from the injection light source **700** through the first terminal thereof, it transmits the signals to the A-band pass/B-band reflection filter **220** connected to the second terminal thereof. Further, after the first optical circulator **210** receives the B band optical signal reflected from the A-band pass/B-band reflection filter **220** through the second terminal thereof, it output the signal to the third terminal thereof, thereby transmitting it to the first terminal of the second optical circulator **240**.

Moreover, the first optical circulator **210** receives a wavelength-locked A band downstream optical signal from the A-band pass/B-band reflection filter **220** through the second terminal thereof, and then it outputs the signal to the third terminal thereof, to thereby transmit it to the first terminal of the second optical circulator **240**.

The A-band pass/B-band reflection filter **220** passes the A band optical signal and reflects the B band optical signal. Accordingly, if the A-band pass/B-band reflection filter **220** receives the A band and the B band optical signals from the second terminal of the first optical circulator **210**, it passes the A band optical signal to transmit it to an A band terminal of the A/B band wavelength mux/demux filter **230** while reflecting the B band optical signal to transmit it to the second terminal of the first optical circulator **210**.

Further, the A-band pass/B-band reflection filter **220** passes the wavelength-locked A band downstream optical signal from the A/B band wavelength mux/demux filter **230** to the second terminal of the first optical circulator **210**.

The A/B band wavelength mux/demux filter **230** includes an A band terminal, a B band terminal and a common band terminal. The A band terminal is connected to the A-band pass/B-band reflection filter **220**; the B band terminal is connected to a third terminal of the second optical circulator **240**; and the common band terminal is connected to a first 1×N optical multiplexer/demultiplexer (not shown) of a central office.

The A/B band wavelength mux/demux filter **230** outputs the optical signal received from the A band terminal or the B band terminal to the common band terminal. Further, the A/B band wavelength mux/demux filter **230** outputs the A band optical signal received from the common band terminal to the A band terminal; and outputs the B band optical signal received from the common band terminal to the B band terminal.

Accordingly, after the A/B band wavelength mux/demux filter **230** receives the A band optical signal through the A band terminal thereof from the A-band pass/B-band reflection filter **220**, it outputs the signal to the common band terminal connected to the first 1×N optical multiplexer/demultiplexer.

Further, the A/B band wavelength mux/demux filter **230** receives the wavelength-locked A band downstream optical signal through the common band terminal from the first 1×N optical multiplexer/demultiplexer and then it outputs the signal to the A band terminal connected to the A-band pass/B-band reflection filter **220**.

Furthermore, the A/B band wavelength mux/demux filter **230** receives the wavelength-locked B band upstream optical signal through the B band terminal from the third terminal of the second optical circulator **240**, and then it outputs the signal to the common band terminal connected to the first 1×N optical multiplexer/demultiplexer.

The first terminal of the second optical circulator **240** is connected to the third terminal of the first optical circulator **210**; a second terminal thereof is connected to the optical cable toward a remote node (not shown); and a third terminal thereof is connected to the B band terminal of the A/B band wavelength mux/demux filter **230**.

The second optical circulator **240** receives the B band injection optical signal outputted from the third terminal of the first optical circulator **210** through the first terminal thereof, and then it outputs the signal to the second terminal thereof to transmit it to the remote node.

Further, the second optical circulator **240** receives the wavelength-locked A band downstream optical signal outputted from the third terminal of the first optical circulator **210** through the first terminal thereof, and then it outputs the signal to the second terminal thereof to transmit it to the remote node.

Moreover, the second optical circulator **240** receives the wavelength-locked B band upstream optical signal outputted from the remote node through the second terminal thereof, and then it outputs the signal to the third terminal thereof to transmit it to the B band terminal of the A/B band wavelength mux/demux filter **230**.

Therefore, the light source distributor **200** in accordance with the first embodiment of the present invention can realize the injection-locked wavelength division multiplexed-passive optical network (WDM-PON) with a minimum optical loss by using the injection light source **700** for generating both A band and B band injection optical signals; two three-terminal optical circulators **210** and **240**; the A-band pass/B-band reflection filter **220**; and the A/B band wavelength mux/demux filter **230**. All of the optical components are commercially available.

In other words, the light source distributor **200** in accordance with the first embodiment of the present invention outputs the A band injection optical signal generated by the injection light source **700** to the common band terminal of the first 1×N optical multiplexer/demultiplexer of the central office with a minimum optical loss; outputs the B band injection optical signal generated by the injection light source **700** to the optical cable toward the remote node with a minimum optical loss; transmits the downstream optical signal outputted from the transmitter of the central office to the optical cable with a minimum optical loss; and transmits the upstream optical signal outputted from the transmitter of the subscriber terminal to the common terminal of the first 1×N optical multiplexer/demultiplexer of the central office with a minimum optical loss.

Hereinafter, a light source distributor in accordance with a second embodiment of the present invention will be described in reference to FIG. **3**. FIG. **3** presents a schematic diagram of a light source distributor **300** for use in an injection-locked wavelength division multiplexed-passive optical network in accordance with the second embodiment of the present invention.

The light source distributor **300** includes a four-terminal optical circulator **310**, an A-band pass/B-band reflection filter **320** and an A/B band wavelength mux/demux filter **330**.

An injection light source **800** generates both an A band optical signal serving as a downstream optical signal and a B band optical signal serving as an upstream optical signal. Although the incoherent light source is mainly used as the injection light source **800**, the coherent light source may also be used if necessary. The injection light source **800** outputs the A band and the B band injection optical signals to a first terminal of the four-terminal optical circulator **310** of the light source distributor **300**.

The first terminal of the four-terminal optical circulator is connected to the injection light source **800**; a second terminal thereof is connected to the A-band pass/B-band reflection filter **320**; and a third terminal thereof is connected to a remote node (not shown); and a fourth terminal thereof is connected to a B band terminal of the A/B band wavelength mux/demux filter **330**.

The four-terminal optical circulator **310** receives the A band injection optical signal and the B band injection optical signals through the first terminal from the injection light source **800**, and then it outputs the signals to the second terminal to transmit them to the A-band pass/B-band reflection filter **320**.

Further, the four-terminal optical circulator **310** receives the B band injection optical signal reflected from the A-band pass/B-band reflection filter **320** or the wavelength-locked A band downstream optical signal passed from the A-band pass/B-band reflection filter **320** through the second terminal, and then it outputs them to the third terminal to transmit them to the remote node.

Furthermore, the four-terminal optical circulator **310** receives the wavelength-locked B band upstream optical signal from the remote terminal through the third terminal, and then it outputs it to the fourth terminal to transmit it to a B band terminal of the A/B band wavelength mux/demux filter **330**.

The A-band pass/B-band reflection filter **320** passes the A band optical signal and reflects the B band optical signal. Accordingly, if the A-band pass/B-band reflection filter **320** receives the A band and the B band injection optical signals from the second terminal of the four-terminal optical circulator **310**, the A-band pass/B-band reflection filter **320** passes the A band optical signal to transmit it to an A band terminal of the A/B band wavelength mux/demux filter **330**; and reflects the B band optical signal to transmit it to the second terminal of the four-terminal optical circulator **310**.

The A/B band wavelength mux/demux filter **330** includes an A band terminal, a B band terminal and a common band terminal. The A band terminal is connected to the A-band pass/B-band reflection filter **320**; the B band terminal is connected to the fourth terminal of the four-terminal optical circulator **310**; and the common band terminal is connected to the first 1×N optical multiplexer/demultiplexer (not shown) of the central office.

The A/B band wavelength mux/demux filter **330** outputs the optical signal, inputted to the A band or the B band terminal, to the common band terminal; outputs the A band optical signal, inputted to the common band terminal, to the A band terminal; and outputs the B band optical signal, inputted to the common band terminal, to the B band terminal.

Accordingly, if the A/B band wavelength mux/demux filter **330** receives the A band injection optical signal transmitted from the A-band pass/B-band reflection filter **320** through the A band terminal, it outputs the signal to the common band terminal to transmit it to the first 1×N optical multiplexer/demultiplexer.

Moreover, the A/B band wavelength mux/demux filter **330** receives the wavelength-locked A band optical signal transmitted from the first 1×N optical multiplexer/demultiplexer through the common band terminal, and then it outputs the signal to the A band terminal to thereby transmit it to the A-band pass/B-band reflection filter **320**.

Furthermore, if the A/B band wavelength mux/demux filter **330** receives the wavelength-locked B band optical signal transmitted from the fourth terminal of the four-terminal optical circulator **310** through the B band terminal thereof, it outputs the signal to the common band terminal thereof, thereby transmitting it to the first 1×N optical multiplexer/demultiplexer.

Therefore, the light source distributor **300** in accordance with the second embodiment of the present invention can realize the injection-locked wavelength division multiplexed-passive optical network (WDM-PON) with a minimum optical loss by using a single injection light source **800** capable of generating both of A band and B band injection optical signals; a single four-terminal optical circulator **310**; an A-band pass/B-band reflection filter **320**; and an A/B band wavelength mux/demux filter **330**.

In other words, the light source distributor **300** in accordance with the second embodiment of the present invention outputs the A band injection optical signal generated by the injection light source **800** to the common band terminal of the first 1×N optical multiplexer/demultiplexer of the central office with a minimum optical loss; outputs the B band injection optical signal generated by the injection light source **800** to the optical cable toward the remote node with a minimum optical loss; transmits the downstream optical signal outputted by the transmitter of the central office to the optical cable with a minimum optical loss; and transmits the upstream optical signal outputted by the transmitter of the subscriber terminal to the common terminal of the first 1×N optical multiplexer/demultiplexer of the central office with a minimum optical loss.

Hereinafter, configuration and operation of an A-band pass/B-band reflection filter in accordance with one embodiment of the present invention will be described in reference to FIG. **4**. FIG. **4** illustrates a schematic diagram of an A-band pass/B-band reflection filter **410** using a fused optical fiber WDM coupler **411** in accordance with the embodiment of the present invention.

If the A band and the B band are far from each other (e.g., generally greater than several tens of nm), the fused optical fiber WDM coupler **411**, which can be obtained at a low price, can couple and decouple two bands. Typically, such a coupler includes three optical ports, i.e., a common band terminal **412**, an A band terminal **413** and a B band terminal **414** as shown in FIG. **4**.

In order to implement the A-band pass/B-band reflection filter **410** having two ports by using such a coupler in accordance with the embodiment of the present invention, a reflecting mirror **415** may be installed at one end of the B band terminal **414**. At this time, the reflecting mirror **415** can be formed just by performing a reflection coating process on the end of the optical fiber of the B band terminal **414**. Moreover, it can also be made by using a commercial reflecting mirror.

Specifically, the A band optical signal passes along the following two paths.

1. the common(A/B) band terminal→the A band terminal
2. the A band terminal→the common(A/B) band terminal

Further, the B band optical signal is reflected has along the following one path: the common(A/B) band terminal→the B band terminal→the reflecting mirror→the B band terminal→the common(A/B) band terminal.

Hereinafter, configuration and operation of an A-band pass/B-band reflection filter using a three-terminal thin film filter in accordance with one embodiment of the present invention will be described in reference to FIG. **5**. FIG. **5** offers a schematic diagram of the A-band pass/B-band reflection filter **510** using the three-terminal thin film filter.

If the A band and the B band are close to each other (e.g., generally within several nm), a thin film filter **512** may be employed to couple and decouple two bands. In general, a three-terminal thin film filter **511** having three optical ports, i.e., a common band terminal **513**, an A band terminal **514** and a B band terminal **515** is configured to have a predetermined angle with respect to a path of the optical signal as shown in FIG. **5**.

In order to implement the A-band pass/B-band reflection filter **510** having two ports by using such a filter, a reflecting mirror **516** is placed at one end of the B band terminal **515** as shown in FIG. **5**. At this time, the reflecting mirror **516** can be formed just by performing the reflection coating process on the end of the optical fiber of the B band terminal **515** or by performing the reflection coating process on the end of the optical ferrule. Further, it can also be made by using a commercial reflecting mirror element.

Specifically, the A band optical signal passes along the following two paths.

1. the common(A/B) band terminal→the A band terminal
2. the A band terminal→the common(A/B) band terminal

Further, the B band optical signal is reflected along the following one path: the common(A/B) band terminal→the B band terminal→the reflecting mirror→the B band terminal→the common(A/B) band terminal.

Hereinafter, configuration and operation of an A-band pass/B-band reflection filter using a two-terminal thin film filter in accordance with one embodiment of the present invention will be described in reference to FIG. **6**. FIG. **6** depicts a schematic diagram of the A-band pass/B-band reflection filter **610** using the two-terminal thin film filter.

If a thin film filter **611** is arranged to have an angle substantially perpendicular to a path of the optical signal, the A-band pass/B-band reflection filter **610** is configured to have two terminals so that an additional reflecting mirror is not necessary. Also, it is easy to manufacture the A-band pass/B-band reflection filter **610** by using the two-terminal filter in lieu of the three-terminal filter.

Specifically, the A band optical signal passes along the following two paths.

1. a first terminal→the thin film filter→a second terminal
2. the second terminal→the thin film filter→the first terminal

Meanwhile, the B band optical signal is reflected along the following two paths.

1. the first terminal→the thin film filter→the first terminal
2. the second terminal→the thin film filter→the second terminal.

While the invention has been shown and described with respect to the embodiments of the present invention, it will be understood by those skilled in the art that various changes and modifications may be made without departing from the spirit and scope of the invention as defined in the following claims.

INDUSTRIAL APPLICABILITY

Therefore, in accordance with the embodiments of the present invention, there is provided the light source distributor for use in the wavelength division multiplexed-passive optical network, the light source distributor capable of providing the optical signal having a respective wavelength to each subscriber by using a single injection light source.

Further, the light source distributor in accordance with the embodiments of the present invention receives the A band injection optical signal to thereby output it to the optical multiplexer/demultiplexer of the central office; receives the B band injection optical signal to thereby output it to the optical cable toward the remote node; transmits the downstream optical signal outputted from the transmitter of the central office to the optical cable; and transmits the upstream optical signal outputted by the transmitter of the subscriber terminal to the optical multiplexer/demultiplexer of the central office with a minimum optical loss.

Furthermore, if the A band and the B band are close to each other like C/L band, it is possible to manufacture the light source distributor by using a single injection light source of a low price and a small size. Accordingly, there is provided a network system optimized to the injection light source capable of outputting both the A band and the B band.

The invention claimed is:

1. A light source distributor for use in a wavelength division multiplexed-passive optical network,

wherein the light source distributor receives an A band and a B band injection optical signals through a single optical terminal from an injection light source for outputting both the A band and the B band injection optical signals;

transmits the A band injection optical signal to a first optical multiplexer/demultiplexer of a central office and the B band injection signal to a second optical multiplexer/demultiplexer of a remote node;

transmits a wavelength-locked A band optical signal received from the first optical multiplexer/demultiplexer to the second optical multiplexer/demultiplexer; and

transmits a wavelength-locked B band optical signal received from the second optical multiplexer/demultiplexer to the first optical multiplexer/demultiplexer,

wherein the light source distributor includes:

an A-band pass/B-band reflection filter for receiving the A band and the B band injection optical signals from the injection light source, passing the A band injection optical signal toward the first optical multiplexer/demultiplexer and reflecting the B band injection optical signal toward the second optical multiplexer/demultiplexer; and

an A/B band wavelength mux/demux filter having an A band terminal, a B band terminal and a common band terminal,

wherein the A/B band wavelength mux/demux filter outputs the optical signal inputted from the A band terminal or the B band terminal to the common band terminal; outputs the A band optical signal inputted from the common band terminal to the A band terminal; and outputs the B band optical signal inputted from the common band terminal to the B band terminal, and

wherein the A band terminal is connected to the A-band pass/B-band reflection filter; the B band terminal is connected to the second optical multiplexer/demultiplexer; and the common band terminal is connected to the first optical multiplexer/demultiplexer.

2. The light source distributor of claim **1**, wherein the A-band pass/B-band reflection filter has a fused fiber WDM coupler.

3. The light source distributor of claim **1**, wherein the A-band pass/B-band reflection filter has a three-terminal thin film filter configured to have a predetermined angle with respect to a path of the optical signal.

4. The light source distributor of claim **1**, wherein the A-band pass/B-band reflection filter has a two-terminal thin film filter configured to have an angle substantially perpendicular to a path of the optical signal.

5. A light source distributor for use in a wavelength division multiplexed-passive optical network,

wherein the light source distributor receives an A band and a B band injection optical signals through a single optical terminal from an injection light source for outputting both the A band and the B band injection optical signals;

transmits the A band injection optical signal to a first optical multiplexer/demultiplexer of a central office and the B band injection signal to a second optical multiplexer/demultiplexer of a remote node;

transmits a wavelength-locked A band optical signal received from the first optical multiplexer/demultiplexer to the second optical multiplexer/demultiplexer; and

transmits a wavelength-locked B band optical signal received from the second optical multiplexer/demultiplexer to the first optical multiplexer/demultiplexer,

wherein the light source distributor includes:

an A-band pass/B-band reflection filter for receiving the A band and the B band injection optical signals from the injection light source, passing the A band injection optical signal toward the first optical multiplexer/demultiplexer and reflecting the B band injection optical signal toward the second optical multiplexer/demultiplexer; and

a first optical circulator and a second optical circulator, each circulator having a first terminal, a second terminal and a third terminal,

wherein the first and the second optical circulators output the optical signal inputted from the first terminal to the second terminal, and output the optical signal inputted from the second terminal to the third terminal, respectively, and

wherein the first terminal of the first optical circulator is connected to the injection light source; the second terminal of the first optical circulator is connected to the A-band pass/B-band reflection filter; the third terminal of the first optical circulator is connected to the first terminal of the second optical circulator; the second terminal of the second optical circulator is connected to the second optical multiplexer/demultiplexer; and the third terminal of the second optical circulator is connected to the B band terminal of the A/B band wavelength mux/demux filter.

6. The light source distributor of claim **5**, wherein the A-band pass/B-band reflection filter has a fused fiber WDM coupler.

7. The light source distributor of claim **5**, wherein the A-band pass/B-band reflection filter has a three-terminal thin film filter configured to have a predetermined angle with respect to a path of the optical signal.

8. The light source distributor of claim **5**, wherein the A-band pass/B-band reflection filter has a two-terminal thin film filter configured to have an angle substantially perpendicular to a path of the optical signal.

9. A light source distributor for use in a wavelength division multiplexed-passive optical network,

wherein the light source distributor receives an A band and a B band injection optical signals through a single optical terminal from an injection light source for outputting both the A band and the B band injection optical signals;

transmits the A band injection optical signal to a first optical multiplexer/demultiplexer of a central office and the B band injection signal to a second optical multiplexer/demultiplexer of a remote node;

transmits a wavelength-locked A band optical signal received from the first optical multiplexer/demultiplexer to the second optical multiplexer/demultiplexer; and

transmits a wavelength-locked B band optical signal received from the second optical multiplexer/demultiplexer to the first optical multiplexer/demultiplexer, and

wherein the light source distributor includes:

an A-band pass/B-band reflection filter for receiving the A band and the B band injection optical signals from the injection light source, passing the A band injection optical signal toward the first optical multiplexer/demultiplexer and reflecting the B band injection optical signal toward the second optical multiplexer/demultiplexer;

an A/B band wavelength mux/demux filter having an A band terminal, a B band terminal and a common band terminal,

wherein the A/B band wavelength mux/demux filter outputs the optical signal inputted from the A band terminal or the B band terminal to the common band terminal; outputs the A band optical signal inputted from the common band terminal to the A band terminal; and outputs the B band optical signal inputted from the common band terminal to the B band terminal; and

a four-terminal optical circulator having a first terminal, a second terminal, a third terminal and a fourth terminal, wherein the four-terminal optical circulator outputs the optical signal inputted from the first terminal to the second terminal; outputs the optical signal inputted from the second terminal to the third terminal; and outputs the optical signal inputted from the third terminal to the fourth terminal,

wherein the first terminal is connected to the injection light source; the second terminal is connected to the A-band pass/B-band reflection filter; the third terminal is connected to the second optical multiplexer/demultiplexer; and the fourth terminal is connected to the B band terminal of the A/B band wavelength mux/demux filter, and

wherein the A band terminal of the A/B band wavelength mux/demux filter is connected to the A-band pass/B-band reflection filter; and the common band terminal of the A/B band wavelength mux/demux filter is connected to the first optical multiplexer/demultiplexer.

10. The light source distributor of claim **9**, wherein the A-band pass/B-band reflection filter has a fused fiber WDM coupler.

11. The light source distributor of claim **9**, wherein the A-band pass/B-band reflection filter has a three-terminal thin film filter configured to have a predetermined angle with respect to a path of the optical signal.

12. The light source distributor of claim **9**, wherein the A-band pass/B-band reflection filter has a two-terminal thin film filter configured to have an angle substantially perpendicular to a path of the optical signal.

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